

series	I	II	III	IV
growth temperature	760°C	700°C	760°C	800°C
PH ₃ pressure	800 pa	800 pa	2600 pa	800 pa
indium composition (nominal/measured)	0.27/ 0.26	0.33/ 0.31	0.10/ 0.15	0.10/ 0.12
grading rate	variable	constant	constant	constant

FIG. 1

Temperature	760°C	760°C
x	0.26	0.31
R _q - (10μm) ² scan area	25 nm ± 6 nm	45 nm ± 25 nm
β ₁₀₀₄	170' ± 8'	303' ± 10'
ρ _{field} - PVTEM	6.3 × 10 ⁵ cm ⁻² ± 2.4 × 10 ⁶ cm ⁻²	1.1 × 10 ⁵ cm ⁻² ± 0.2 × 10 ⁶ cm ⁻²
ρ _{bleed} - CL	377 cm ⁻¹	1128 cm ⁻¹
ρ _{lineer} - PVTEM	2.7 × 10 ⁴ cm ⁻¹	1.2 × 10 ⁵ cm ⁻¹
ρ _{averall} - PVTEM + CL	1.6 × 10 ⁷ cm ⁻²	2.5 × 10 ⁸ cm ⁻²
ρ _{branch} (transverse) - PVTEM	6000 cm ⁻¹ ± 196 cm ⁻¹	4773 cm ⁻¹ ± 693 cm ⁻¹
ρ _{branch} (axial) - PVTEM	939 cm ⁻¹ ± 61 cm ⁻¹	832 cm ⁻¹ ± 110 cm ⁻¹

FIG. 3

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FIG. 2

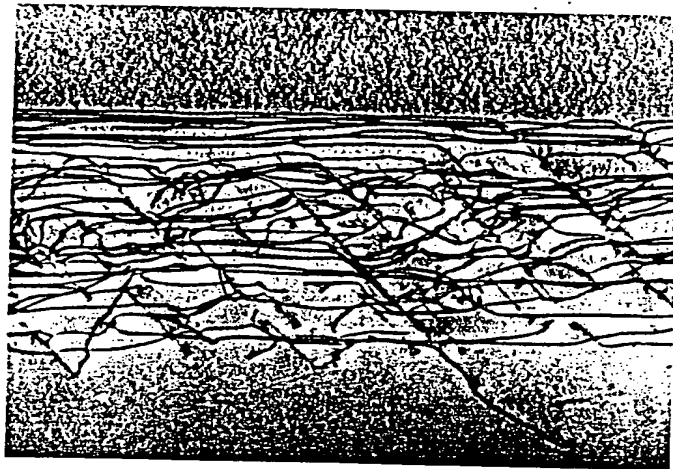


FIG. 4A



FIG. 4B



FIG. 5

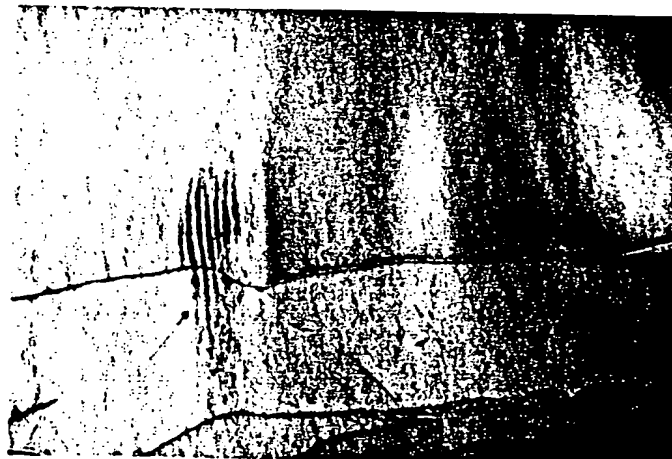


FIG. 6A



FIG. 6B



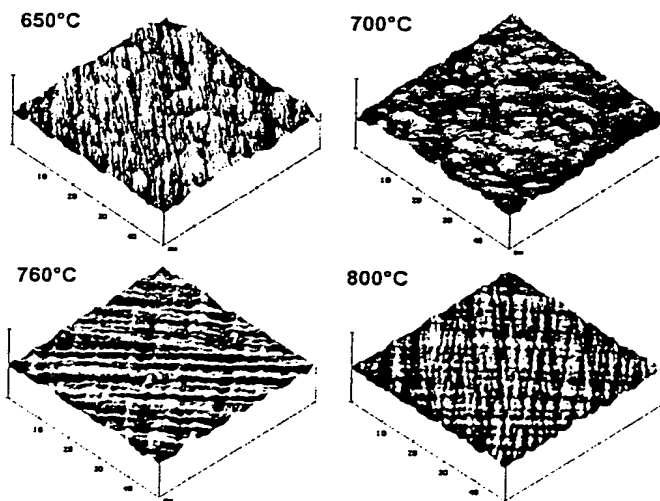
FIG. 8A



FIG. 8B



FIG. 10



Temperature	700°C	760°C	810°C
x	0.34	0.31	0.36
$R_q - (10\mu\text{m})^2$	13 nm \pm 2 nm	68 nm \pm 25 nm	118 nm \pm 20 nm
$\beta_{(004)}$	275' \pm 10'	420' \pm 30'	—
$\rho_{\text{field}} - \text{CL}$	$4.9 \times 10^6 \text{ cm}^{-2}$ $\pm 0.9 \times 10^6 \text{ cm}^{-2}$	—	—
$\rho_{\text{field}} - \text{PVTEM}$	$4.4 \times 10^6 \text{ cm}^{-2}$ $\pm 1.0 \times 10^6 \text{ cm}^{-2}$	—	—
$\rho_{\text{pileup}} - \text{CL}$	92 $\text{cm}^{-1} \pm 23 \text{ cm}^{-1}$	>2000 cm^{-1}	—
$\rho_{\text{linear}} - \text{CL} + \text{PVTEM}$	$2.1 \times 10^5 \text{ cm}^{-1}$	—	—
$\rho_{\text{overall}} - \text{CL} + \text{PVTEM}$	$6.8 \times 10^6 \text{ cm}^{-2}$ $\pm 2.0 \times 10^6 \text{ cm}^{-2}$	$1.5 \times 10^9 \text{ cm}^{-2}$ $\pm 0.3 \times 10^9 \text{ cm}^{-2}$	—
$\rho_{\text{branch}} (\text{transverse})$	7970 cm^{-1} $\pm 327 \text{ cm}^{-1}$	5433 cm^{-1} $\pm 529 \text{ cm}^{-1}$	—

FIG. 7

Temperature	650°C	700°C	760°C	800°C
x	0.15	0.09	0.11	0.12
$R_q - (10\mu\text{m})^2 \text{ scan}$	8.5 nm \pm 1.5 nm	7.7 nm \pm 1 nm	6.0 nm \pm 0.5 nm	4.9 nm \pm 0.5 nm
$R_q - (50\mu\text{m})^2 \text{ scan}$	12.2 nm \pm 1.5 nm	10.5 nm \pm 1 nm	7.4 nm \pm 0.5 nm	6.0 nm \pm 0.5 nm
$\beta_{(004)}$	93' \pm 5'	58' \pm 3'	54' \pm 3'	53' \pm 3'
$\rho_{\text{field}} - \text{PVTEM}$	$1.2 \times 10^7 \text{ cm}^{-2}$ $\pm 0.3 \times 10^7 \text{ cm}^{-2}$	$3.9 \times 10^6 \text{ cm}^{-2}$ $\pm 1.4 \times 10^6 \text{ cm}^{-2}$	$1.1 \times 10^6 \text{ cm}^{-2}$ $\pm 0.6 \times 10^6 \text{ cm}^{-2}$	$4.0 \times 10^5 \text{ cm}^{-2}$ $\pm 1.9 \times 10^5 \text{ cm}^{-2}$
$\rho_{\text{branch}} (\text{transverse}) - \text{PVTEM}$	26911 cm^{-1} $\pm 2265 \text{ cm}^{-1}$	9808 cm^{-1} $\pm 654 \text{ cm}^{-1}$	—	—
$\rho_{\text{branch}} (\text{transverse}) - \text{AFM}$	24114 cm^{-1} $\pm 7312 \text{ cm}^{-1}$	—	—	—
Crosshatch Wavelength <011>-A	—	—	3.4 $\mu\text{m} \pm 0.9 \mu\text{m}$, 8.7 $\mu\text{m} \pm 0.5 \mu\text{m}$	3.0 $\mu\text{m} \pm 0.3 \mu\text{m}$, 7.0 $\mu\text{m} \pm 1.1 \mu\text{m}$
Crosshatch Amplitude <011>-A	—	—	9.9 nm \pm 1.5 nm, 14.7 nm \pm 2.4 nm	7.9 nm \pm 1.2 nm, 11.7 nm \pm 1.3 nm
Crosshatch Wavelength <011>-B	—	—	4.6 $\mu\text{m} \pm 0.7 \mu\text{m}$, 8.5 $\mu\text{m} \pm 1.3 \mu\text{m}$	3.0 $\mu\text{m} \pm 0.4 \mu\text{m}$, 6.3 $\mu\text{m} \pm 1.5 \mu\text{m}$
Crosshatch Amplitude <011>-B	—	—	10.5 nm \pm 2.9 nm, 17.4 nm \pm 2.7 nm	8.6 nm \pm 1.2 nm, 12.4 nm \pm 1.7 nm

FIG. 9

Temperature	760°C/700°C/ 650°C
x	0.389
$R_q - (10\mu\text{m})^2 \text{ scan}$	13 nm \pm 4 nm
$\beta_{(004)}$	277' \pm 10'
$\rho_{\text{field}} - \text{CL}$	$4.1 \times 10^6 \text{ cm}^{-2}$ $\pm 0.5 \times 10^6 \text{ cm}^{-2}$
$\rho_{\text{field}} - \text{PVTEM}$	$3.7 \times 10^6 \text{ cm}^{-2}$ $\pm 0.8 \times 10^6 \text{ cm}^{-2}$
$\rho_{\text{pileup}} - \text{CL}$	71 $\text{cm}^{-1} \pm 18 \text{ cm}^{-1}$
$\rho_{\text{linear}} - \text{CL} + \text{PVTEM}$	$8.5 \times 10^3 \text{ cm}^{-1}$
$\rho_{\text{overall}} - \text{CL} + \text{PVTEM}$	$4.7 \times 10^6 \text{ cm}^{-2}$ $\pm 1.1 \times 10^6 \text{ cm}^{-2}$
$\rho_{\text{branch}} (\text{transverse}) - \text{PVTEM}$	24636 cm^{-1} $\pm 821 \text{ cm}^{-1}$
$\rho_{\text{branch}} (\text{transverse}) - \text{AFM}$	24000 cm^{-1} $\pm \text{XXX cm}^{-1}$

FIG. 12

FIG. 11A



FIG. 11E

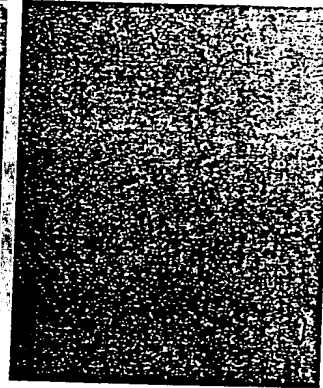


FIG. 13A



FIG. 13B

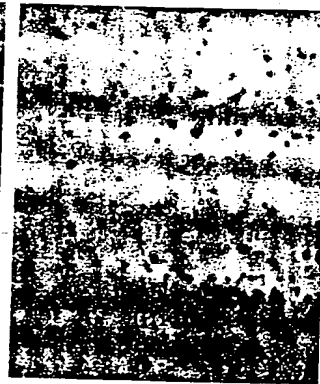


FIG. 14

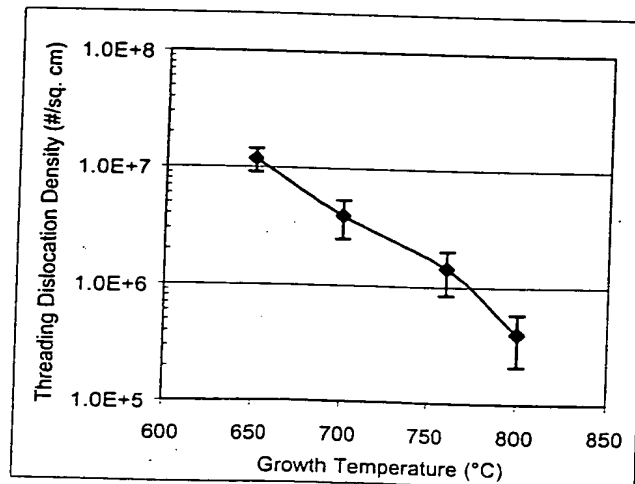


FIG. 15

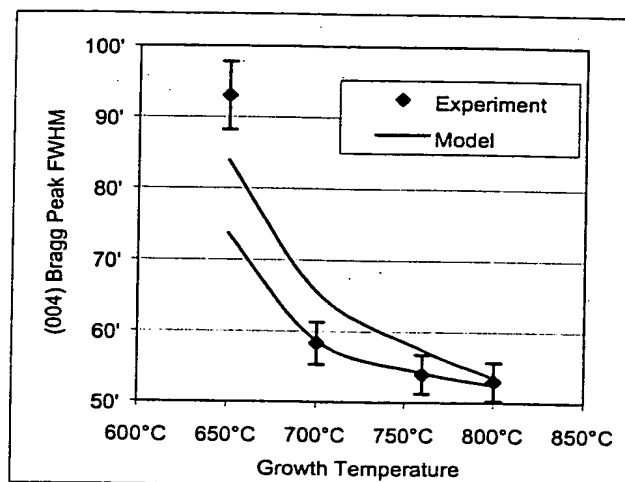


FIG. 16

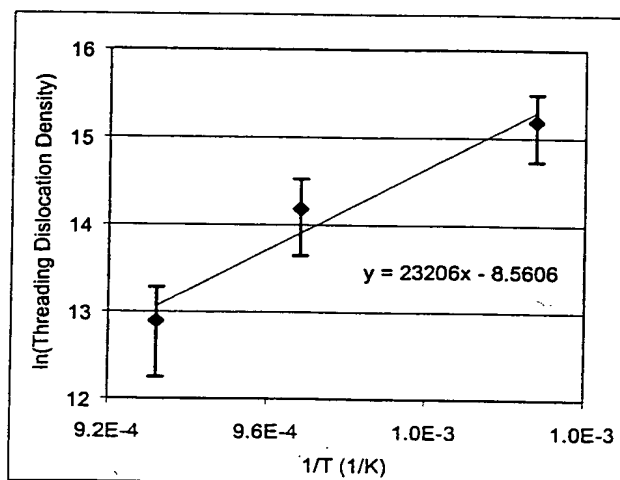


FIG. 17

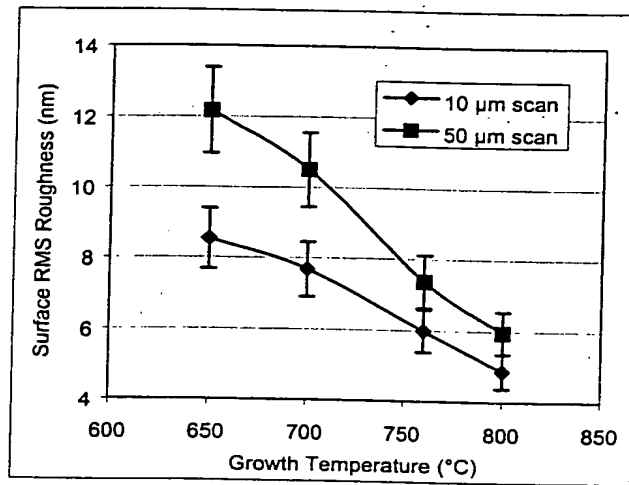


FIG. 18

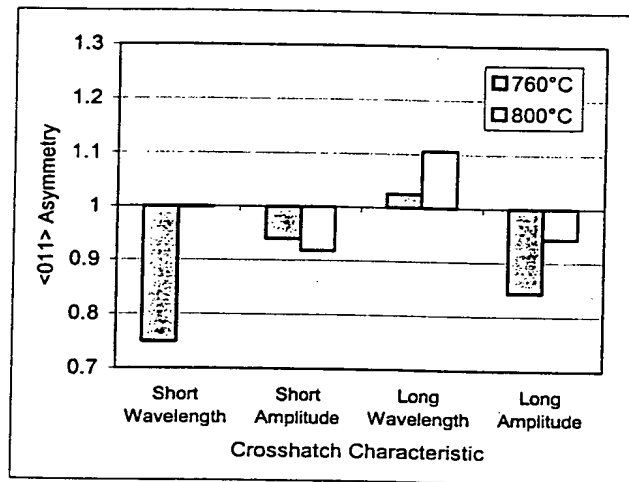


FIG. 19

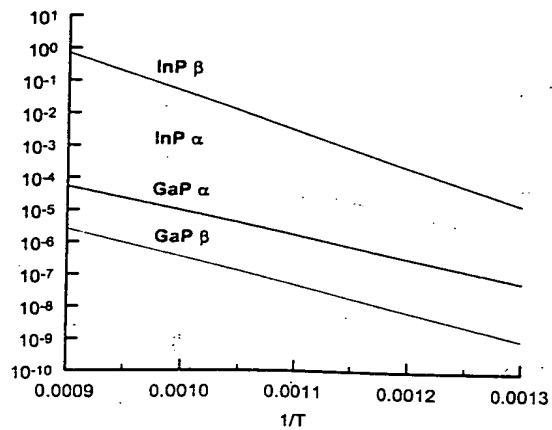


FIG. 20

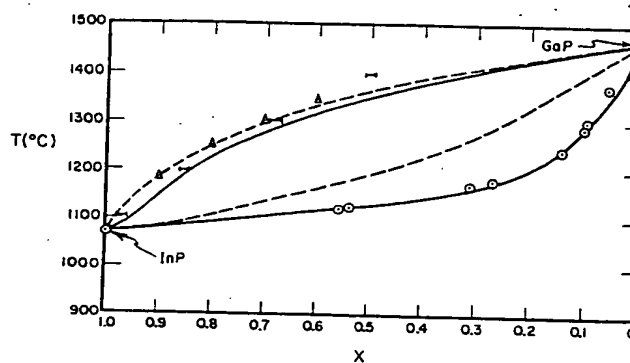


FIG. 21

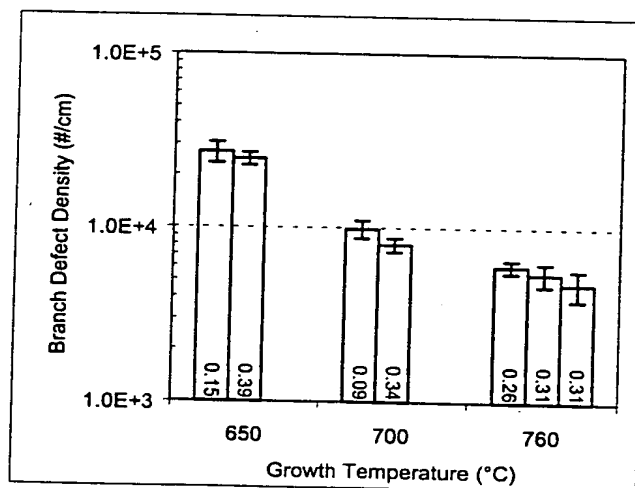


FIG. 22

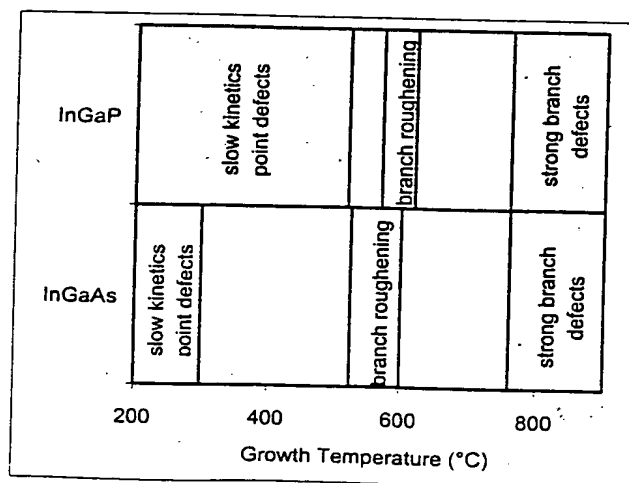


FIG. 23

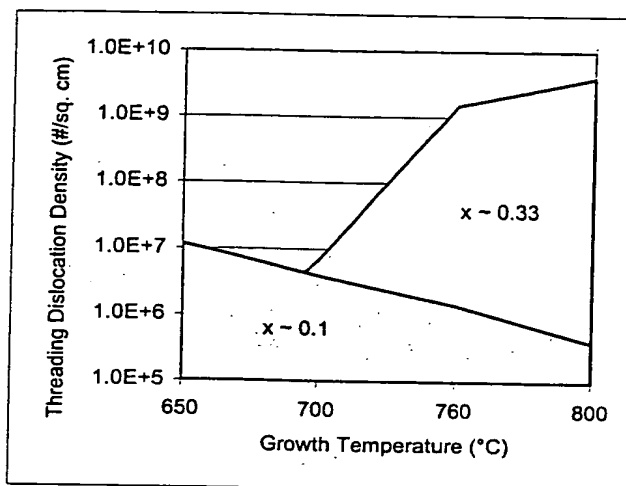


FIG. 24

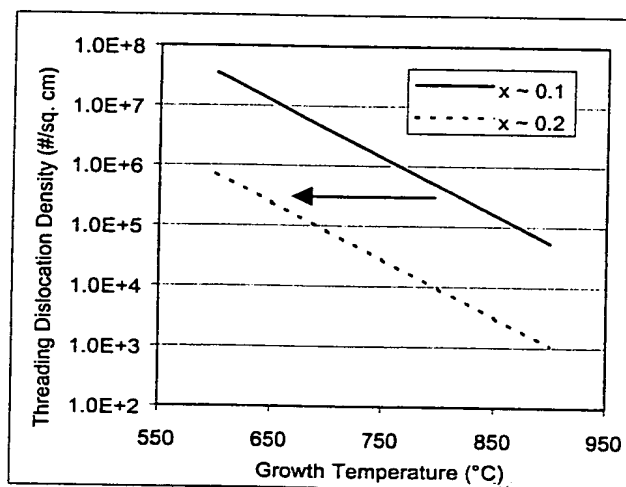


FIG. 25

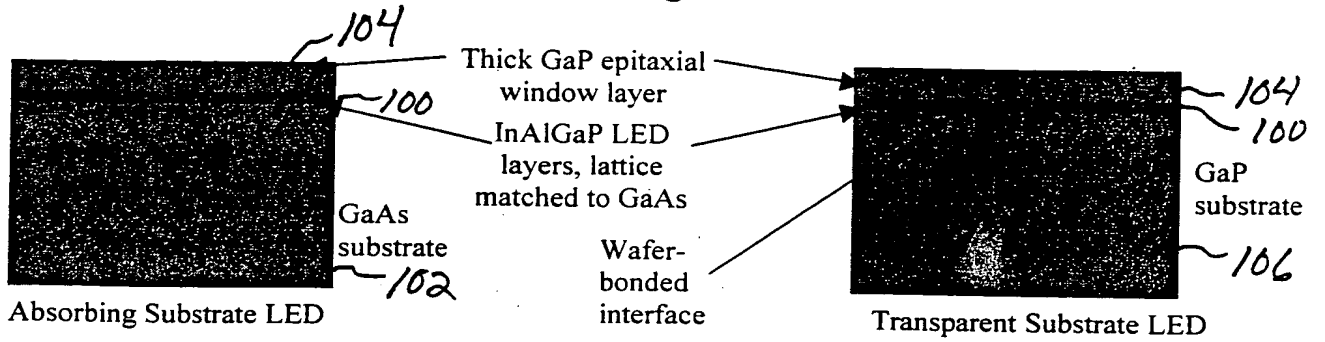
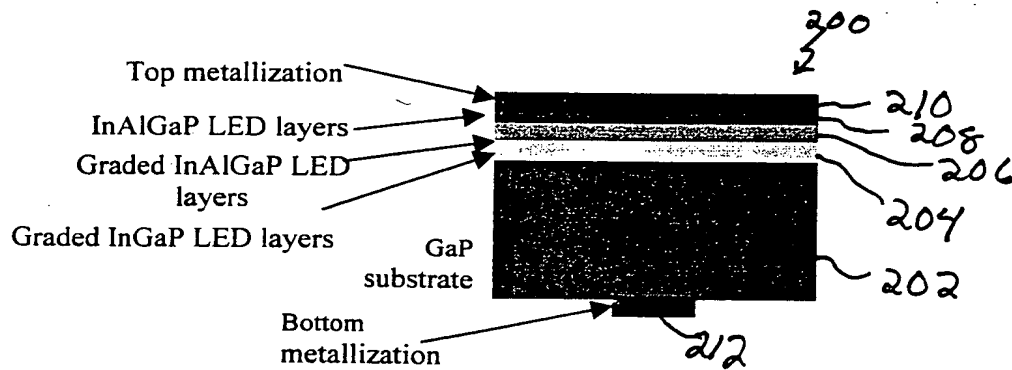


FIG. 26



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